



SAP Leonardo **Live**

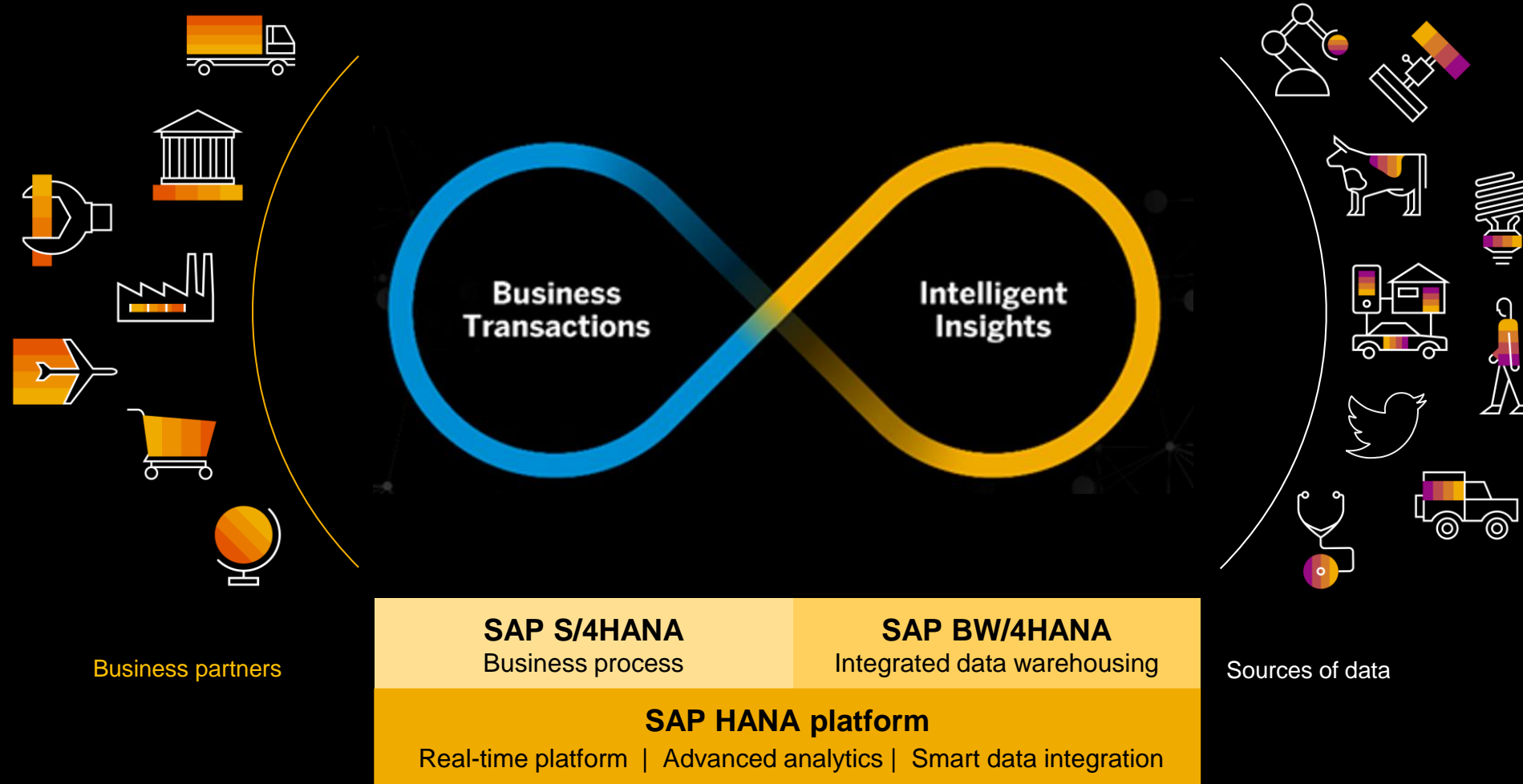
Not just another business conference

Leading Successful Digital Transformation with **Smart Analytics and Machine Learning**

Waldemar Adams, SVP, SAP Analytics and Insight, Europe, Middle East, and Africa
@adamsw

PUBLIC

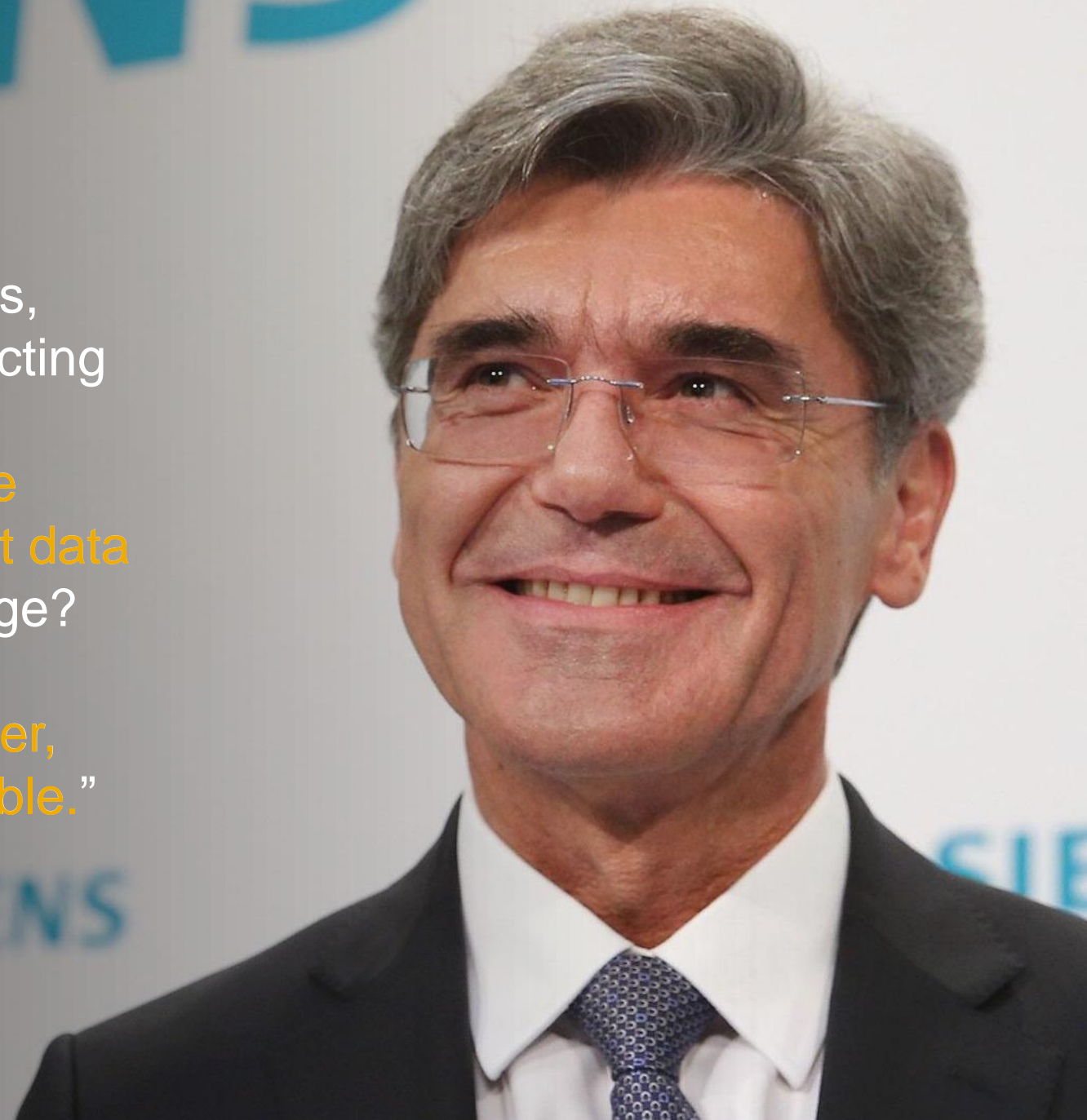
Enterprise architecture for the digital economy



“Relating to the Internet of Things, there’s a two-step process: collecting data and making use of it.

Once I have data, how do I make **meaningful analytics** out of that data so my customer has an advantage? My customer would **pay me for information that makes life easier, better, less costly, or more valuable.**”

Joe Kaeser, CEO, Siemens



Technology priorities for 2017 and beyond

Analytics

#1

10 out of
12 years
2005–17*

*Gartner annual CIO survey 2017

Rank	Technology	Trend
1	BI/analytics	↔
2	Cloud services/solutions	↑
3	Digitalization/digital marketing	↑
4	Infrastructure and data center	↑
5	Mobile	↓
6	Cyber/information security	↑
7	Industry-specific applications	↑
8	ERP	↓
9	Networking, voice, and data comms	↑
10	Customer relationships	↓

Why business needs a new way for managing change



What happened?
Why did it happen?
What could we have done?
How could we change?



The old world of reactive opportunity finding
Three to six months before you know it worked (or didn't work)
"I think" or "I believe"

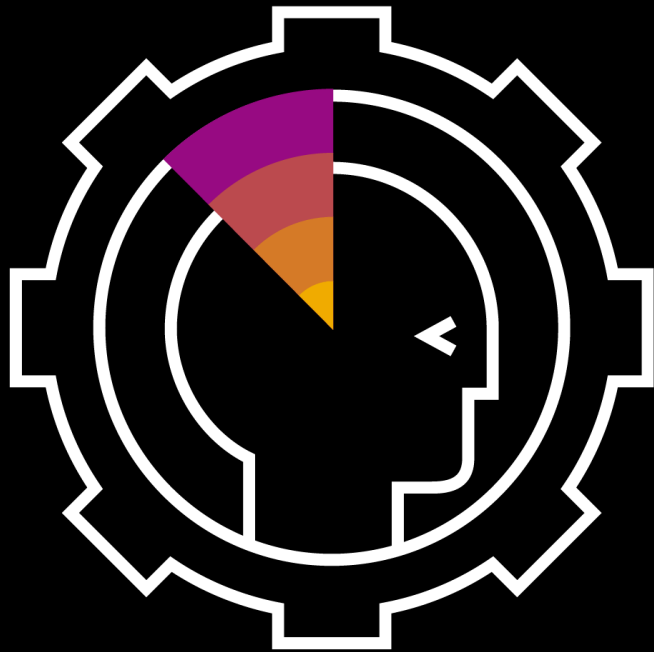
What is happening?
Why is it happening?
Choose the best options!
Model and embed change!



Proactive opportunity hunting
Rapid implementation of change
We have a plan

Market trends – digital transformation

Emerging systems of intelligence



Artificial intelligence (AI) and machine learning (ML), the Internet of Things (IoT), insights

By 2018, **75%** of enterprise and ISV development will include AI or ML. – IDC



Embedded machine learning, analytics providing built-in guidance

By 2019, **APIs** will be the primary mechanism to connect data, algorithms, and decision services. – IDC



Conversational applications: the new user experience

By 2019, **natural-language generation** will be a standard feature of **90%** of modern BI platforms. – Gartner

Catch the wind of change



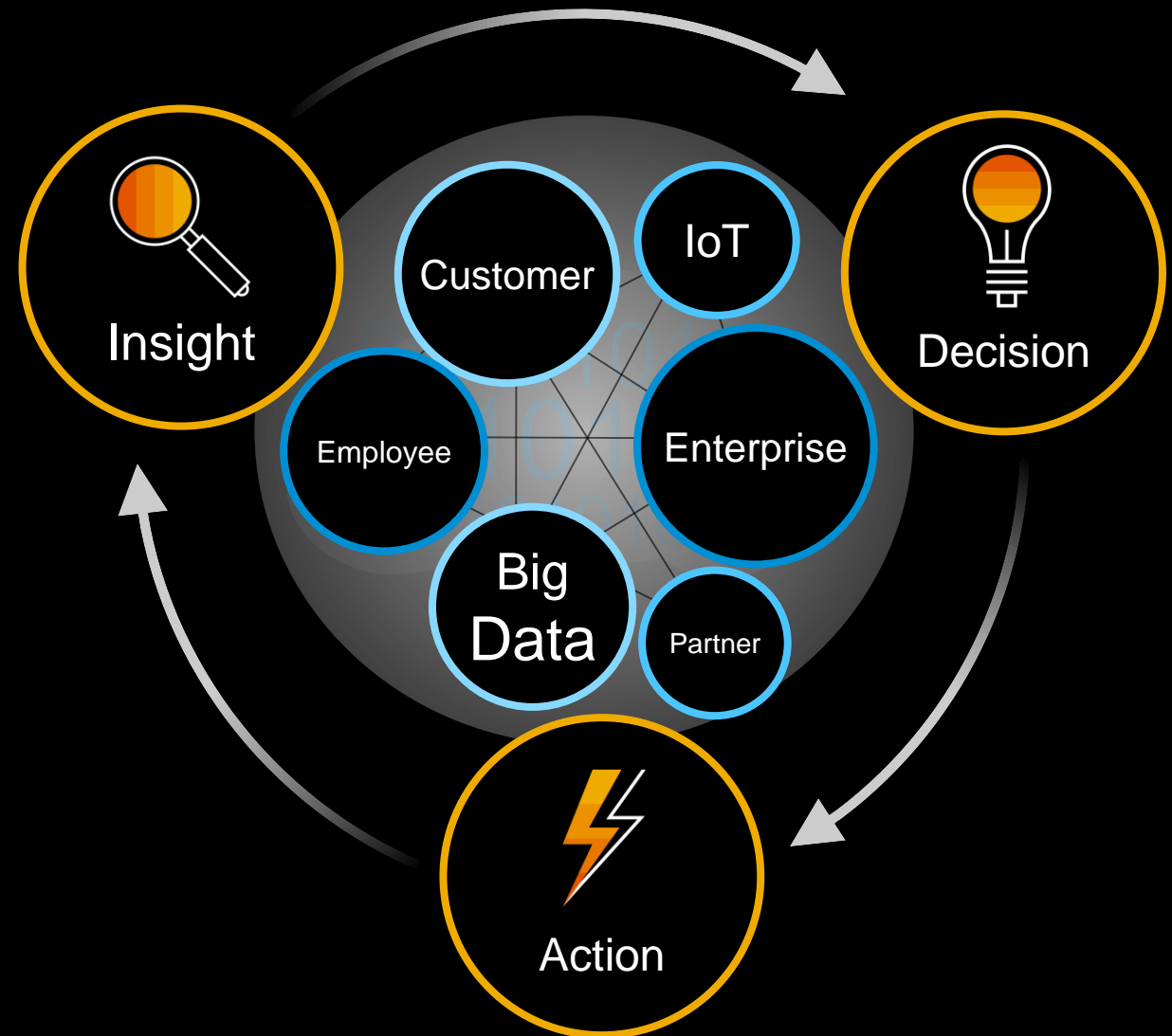
So, every organization must ...

1. Uncover “unknowns”
2. Predict the future
3. Empower everyone to make better decisions
4. Turn decisions into actions



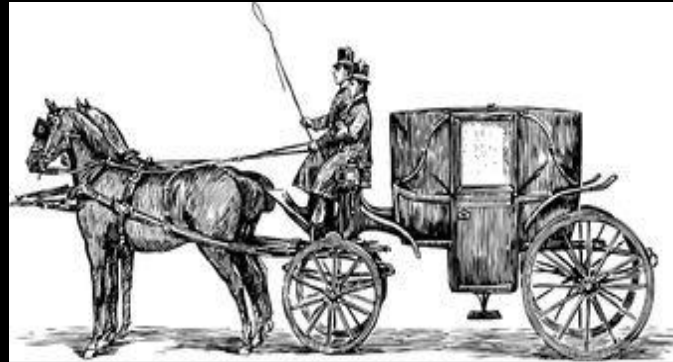
SAP can help you **lead** your organization's **digital journey**

Providing people with the **insight** they need to make better **decisions** and enabling them to **act** are what will distinguish whether your organization is the disruptor or disrupted.





Technology in motion



RDBMS era



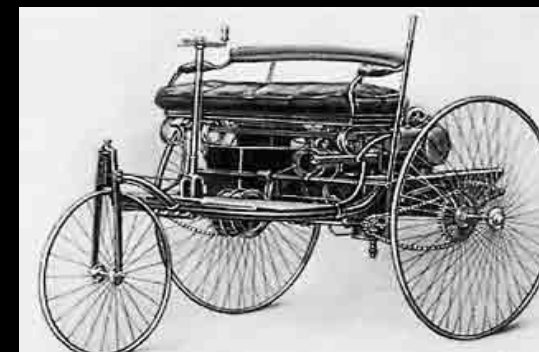
SAP HANA in-memory



BI and (predictive) analytics



SAP S/4HANA AND SAP BW/4HANA



First car

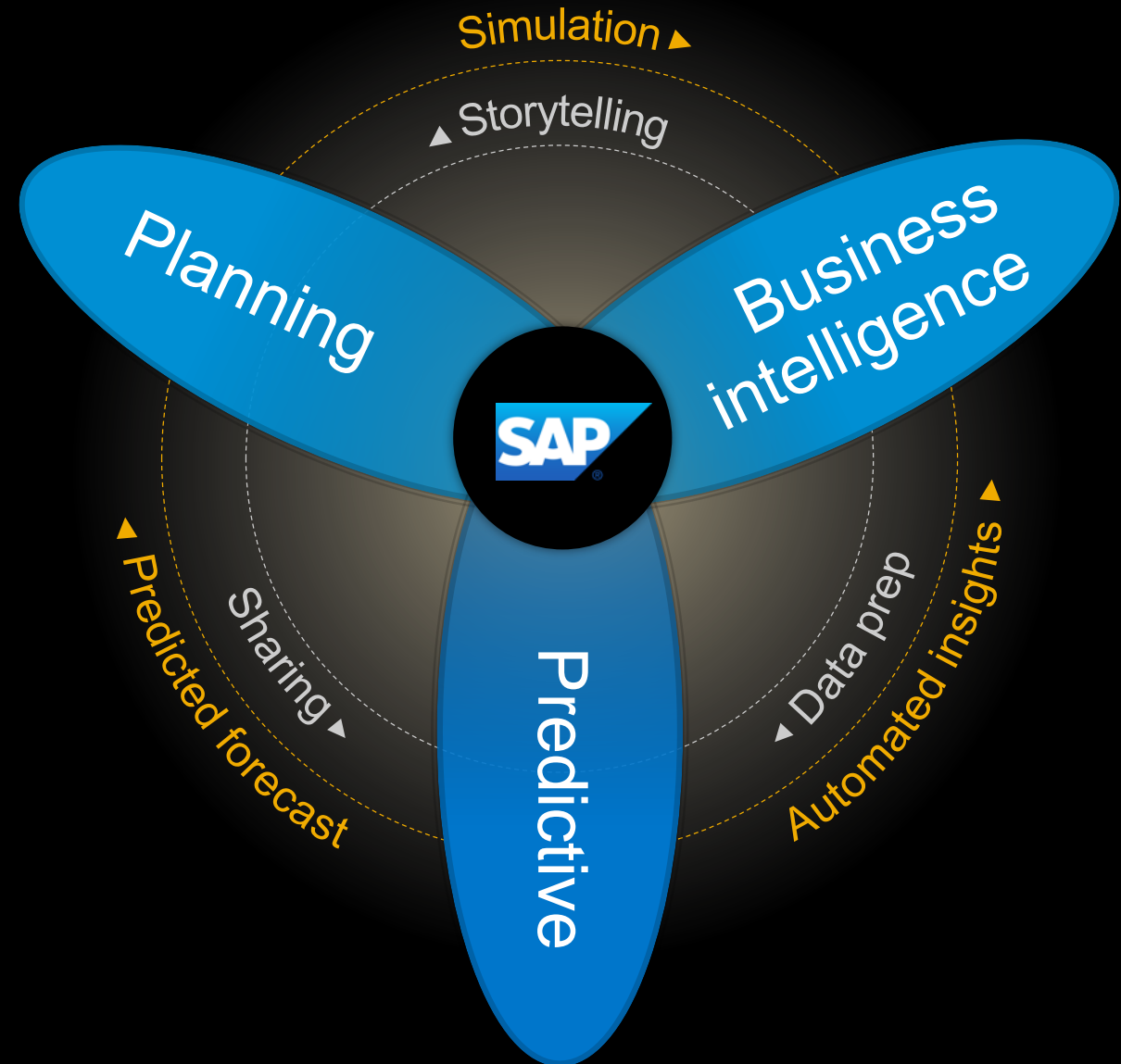
To stay ahead, organizations need to:

- Give employees the freedom to analyze the specifics of their business
- Simulate and predict what could happen next
- Plan and collaborate on a course of action
- Implement decisions to derive immediate value

SAP
Analytics

#1

in market share for
more than 10 years



SAP Leonardo

Digital Innovation System

Solution Ideation
& Vision

Rapid
Prototyping

Business Case
Development

Technology
Blueprint

SAP Leonardo
Capabilities

Design Thinking
Services



SAP Cloud Platform

Microservices | Open APIs | Flexible Runtimes | Integration

Multi-Cloud Infrastructure

SAP Data Center

 Google Cloud Platform

Microsoft Azure

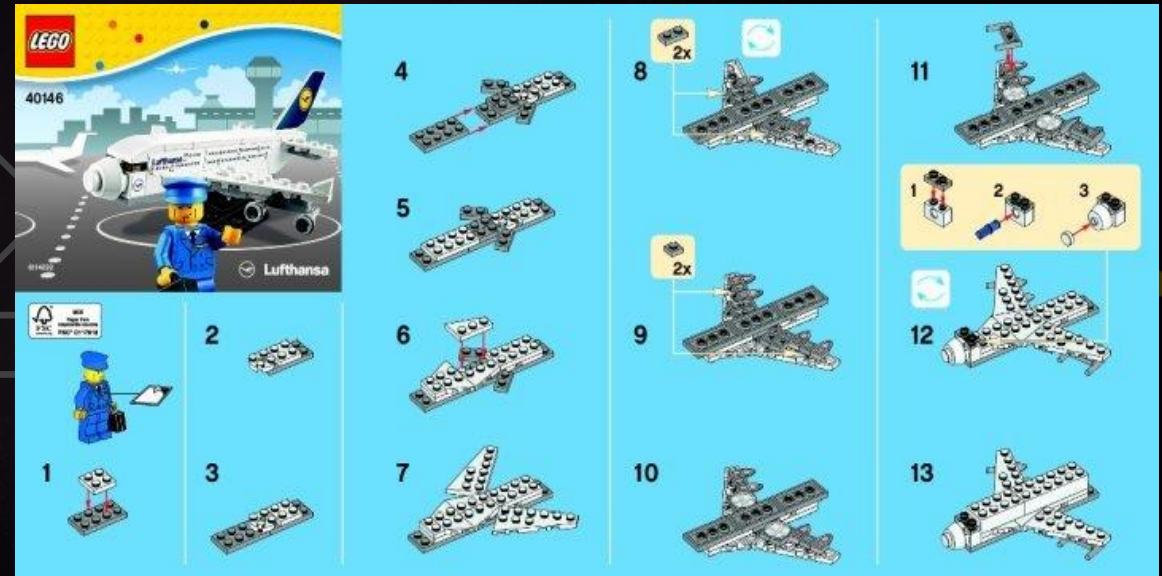
 amazon
web services

SAP Leonardo: virtuous cycle of innovation

Systems of Record



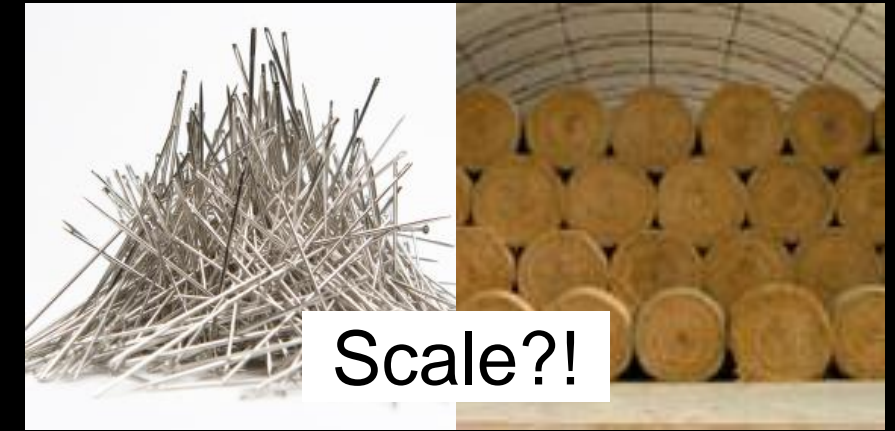
System of Intelligence



SAP Leonardo makes SAP applications more intelligent and capable.

SAP Leonardo delivers capabilities to create and scale new intelligent applications.

Why machine learning? Discover the “unknown unknown”



		Knowledge	
		Knowns	Unknowns
Metaknowledge	Known	Known knows	Known unknowns
	Unknown	Unknown knows	Unknown unknowns

Sven Sachsalber found a needle in a haystack in less than 48 hours.

In-memory predictive analytics with SAP HANA

PAL algorithms in SAP HANA 2

Classification analysis

- CART
- C4.5 decision tree analysis
- CHAID decision tree analysis
- K nearest neighbor
- Logistic regression elastic net
- Back-propagation (neural network)
- Naïve Bayes
- Support vector machine
- Random forests
- **Gradient boosting decision tree***
- **Linear discriminant analysis (LDA)***
- Confusion matrix
- Area under curve (AUC)
- Parameter selection/model evaluation

Regression

- Multiple linear regression elastic net
- Polynomial, exponential, bi-variate geometric, bi-variate logarithmic regression
- **Generalized linear model***
- **Cox proportional hazards model***

Cluster analysis

- ABC classification
- DBSCAN
- K-means
- K-medoid clustering
- K-medians
- Kohonen self-organized Maps
- Agglomerate hierarchical
- Affinity propagation
- Latent Dirichlet allocation (LDA)
- Gaussian mixture model (GMM)
- Cluster assignment

Time series analysis

- Single/double/ brown /triple exp. smoothing
- Forecast smoothing
- Auto-ARIMA/seasonal ARIMA
- Croston method
- Forecast accuracy measure
- Linear regression with damped trend and seasonal adjust
- Test for white noise, trend, seasonality
- **Fast Fourier transform (FFT)***
- **Correlation function***

Association analysis

- Apriori
- Apriori Lite
- FP-growth
- KORD – top K rule discovery
- **Sequential pattern mining***

Probability distribution

- Distribution fit/Weibull analysis
- Cumulative distribution function
- Quantile function
- Kaplan-Meier survival analysis

Outlier detection

- Inter-quartile range test (Tukey's test)
- Variance test
- Anomaly detection
- Grubbs outlier test

Link prediction

- Common neighbors
- Jaccard's coefficient
- Adamic/Adar
- Katzβ

Statistic functions

- Mean, median, variance, standard deviation, kurtosis, skewness
- Covariance matrix
- Pearson correlations matrix
- Chi-squared tests:
 - Test of quality of fit
 - Test of independence
- F-test (variance equal test)
- **Data summary**

Data preparation

- Sampling
- Binning
- Scaling
- Partitioning
- Principal component analysis (PCA)/PCA projection

Other

- Weighted scores table
- Substitute missing values

* New in SAP HANA 2 SPS0

Predictive analytics and data mining versus machine learning

Data scientists



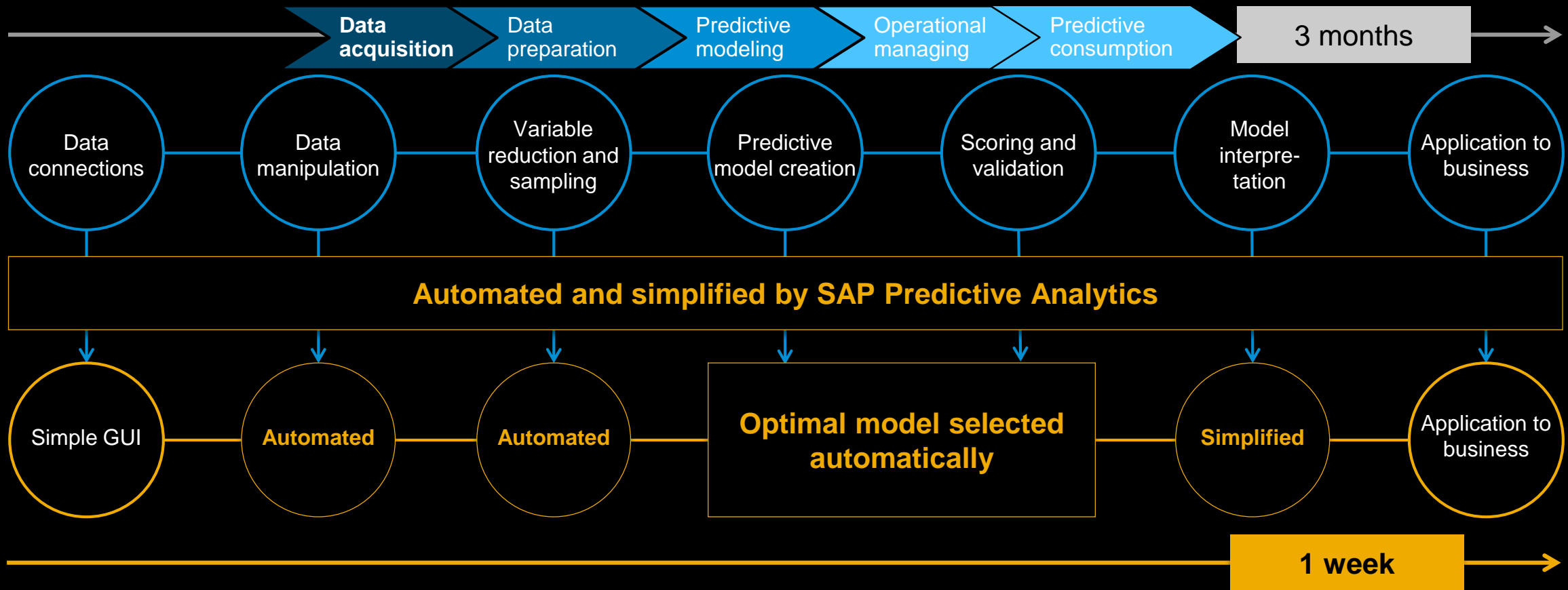
Machine learning



Predictive for everyone



Improve time to value



Live example

Before: 6 people x 8 weeks = 20 models
 After: 1 person x 7 days = 400 models

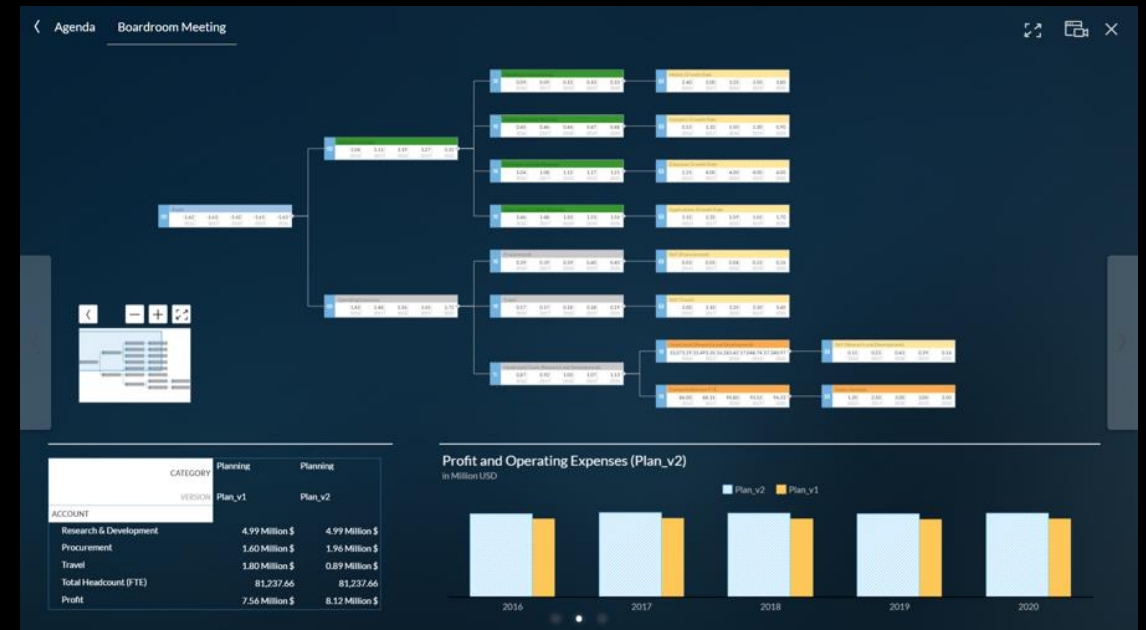
Reimagine your boardroom for the digital economy

- Total transparency
- Instant data-driven insights
- Align on one source of truth
- Simplified meetings with actions

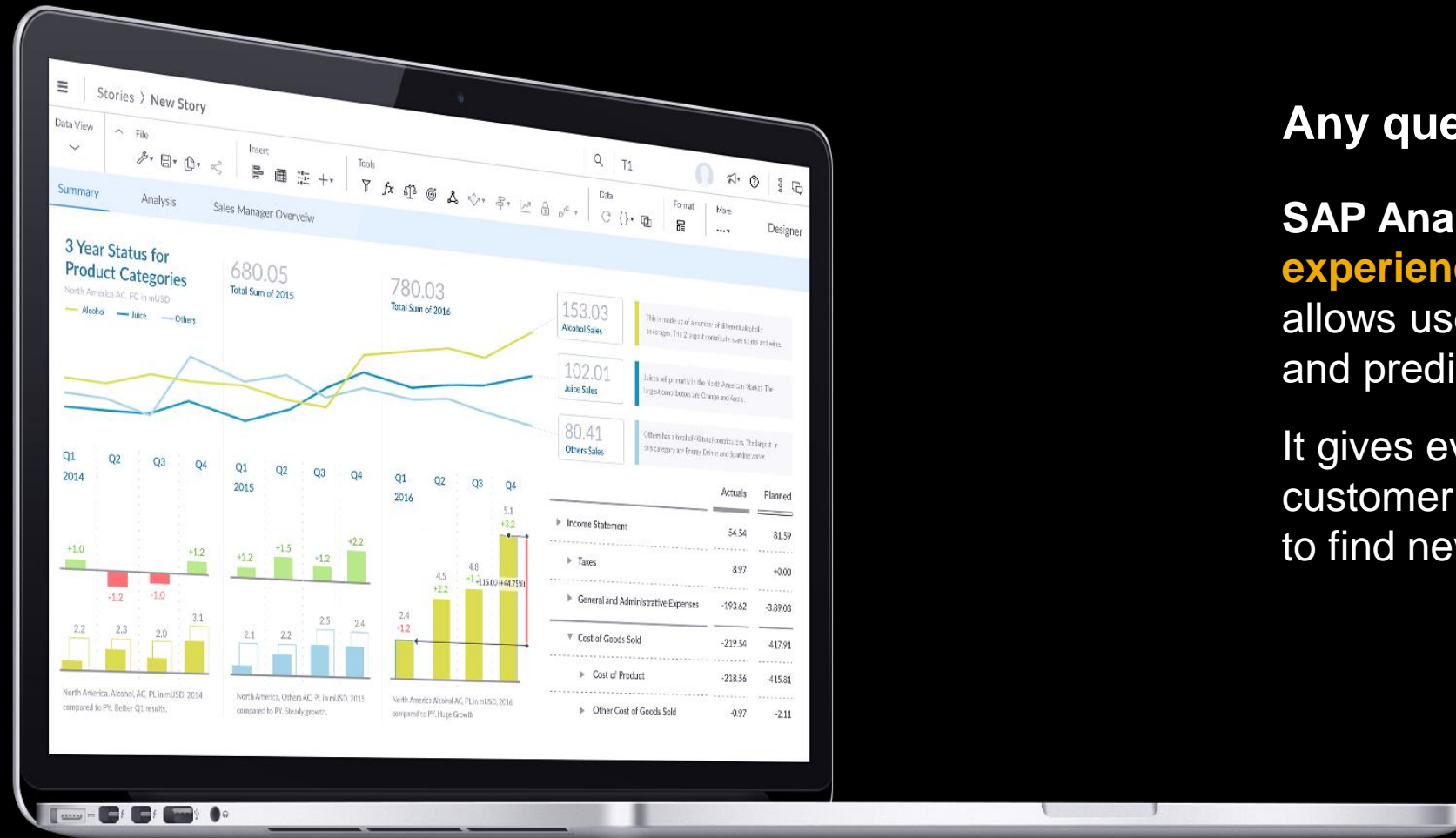


Instant data-driven insights

- Answer ad hoc questions on the fly
- Simulate impact of decisions
- Uncover hidden insights with guided machine discovery



SAP Analytics Cloud demonstration of machine learning



Any question, anyone, anytime

SAP Analytics Cloud is a new, **single experience** for decision making that allows users to discover, visualize, plan, and predict – all in one place.

It gives everyone, whether in front of the customer or in the boardroom, the power to find new **insights** and take action.

f CONTRACTORS

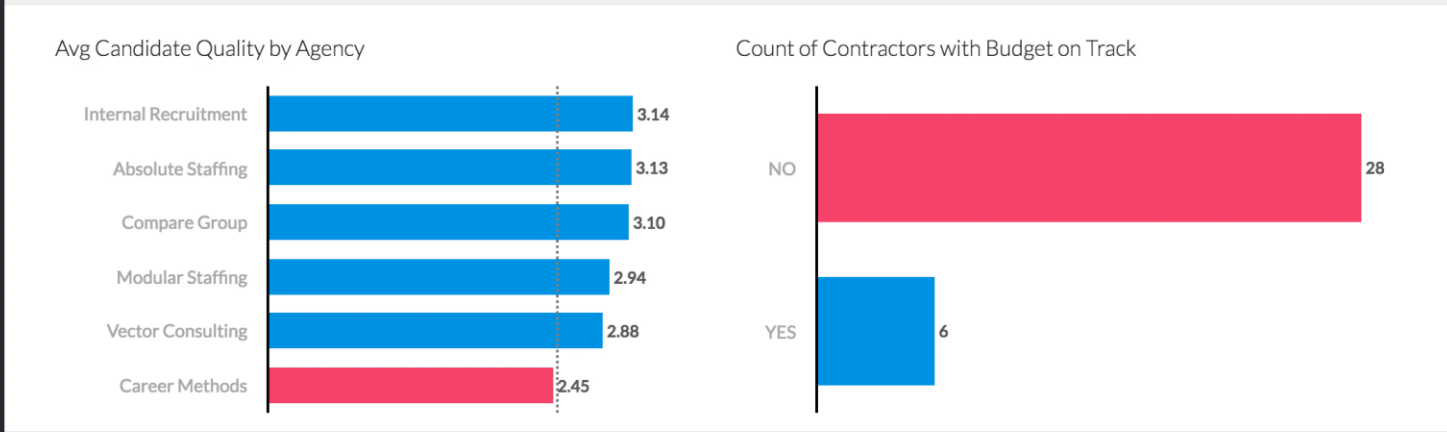
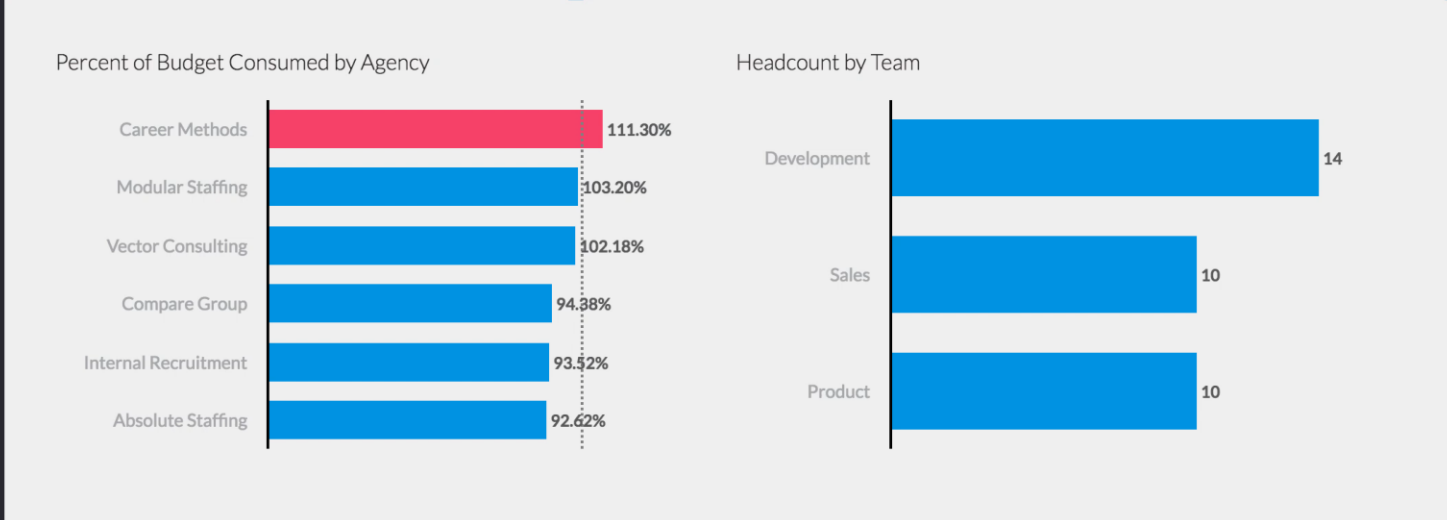
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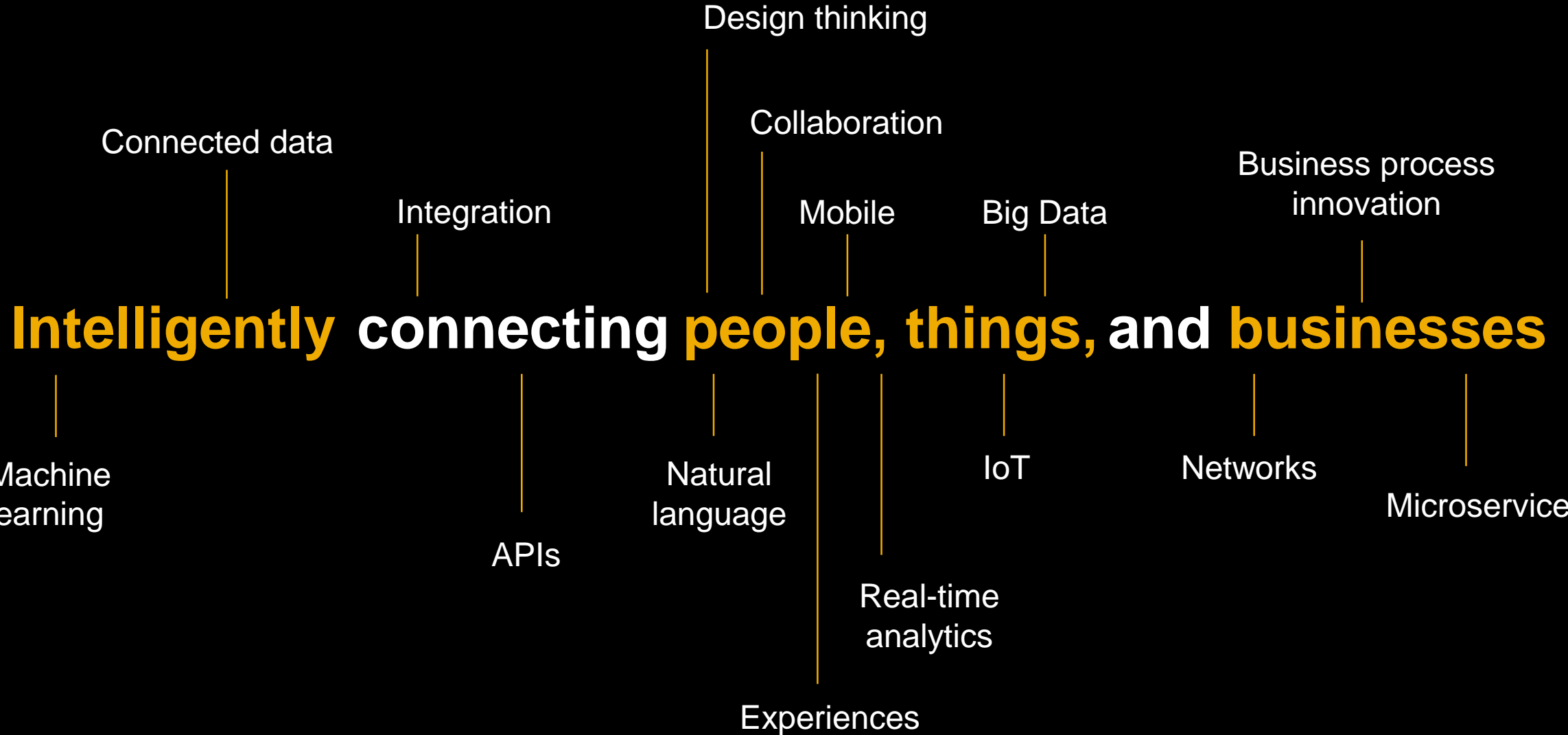
34
Contractors

3.32
Avg Candidate Quality

10.7
Total Billable Hours

4.56
Amount Spent





Thank you.

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